RESEARCH ARTICLE

Efficacy of Coconut water, Vermiwash and Neem Extract on Plant Growth and Rhizosphere Bacterial Enhancers Towards Soil Sustainability

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ABSTRACT: Plant growth regulators are known to control plants physiological and biochemical processes. Physico, chemical and Nutrients analysis was recorded in all base nutrients and Soil. The Vermiwash was found to improve the trace element content of the soil. The biometric analysis on 20th, 30th, 40th day for Maize and Rye plant was carried out. Qualitative phytochemical analysis was performed for the fresh leaf extracts of Maize and Rye plant. The characterization of Rhizospheric bacteria for Plant Growth Promoting Traits (PGPT) was studied. These bacteria was assayed for IAA assay, the results showed that pink colour was observed in all the strains. It indicates that two gram negative and one gram positive strains had plant growth promoting hormone (IAA). The antioxidant activity of plant namely Maize and Rye which was grown under different concentration was also studied.

KEYWORDS: Coconut water, Vermiwash, Neem extract, Micro-organism, Extraction, Maize, Rye.

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1. INTRODUCTION

Soil is an integral compartment of the environment and the central organizer of the terrestrial ecosystem. Soil quality is the fundamental foundation of environmental quality largely governed by soil organic matter (SOM) content, which is dynamic and responds effectively to changes in soil management, tillage and plant production [1]. Vermiwash protect the environment from various chemical fertilizers. Vermiwash is a liquid extract of organic waste material, which is collected after the passage of water through the different layers of earthworm culture units. Vermiwash is used as a liquid major nutritive and enzymatic element for promoting growth of all green plants Vermiwash, the extracted body fluid of earthworms is also nutrient rich with components promoting good plant growth [2]. Since the 2000s, research focus has somewhat shifted away from individual microbial strains, and toward documenting the abundance and diversity of the root microbiome through metagenomics. Results from such sequencing studies have shown that the rhizospheric niche is a hotspot of ecological richness, with plant roots hosting an enormous array of microbial taxa [3]. However, minerals, organic matter and microorganisms should not be considered as separate entities, but rather a united system constantly in close association and interactions with each other in soil environments. Interactions of these components have enormous impact on terrestrial processes critical to environmental quality and ecosystem health. Presently use of chemical fertilizers is increasing in agriculture day by day which ultimately destroys the fertility of soil. Control the hazardous effect of chemical fertilizer can be reduced by the use of organic fertilizers. The plants was grown using Coconut water, Vermiwash and Neem extract and the Plant Growth and Rhizosphere Bacterial Enhancers growth was studied.

2. MATERIALS AND METHODS

2.1. Collection Of Coconut water, Vermiwash and Neem Extract

Coconut water were collected from in an around Erode district, Tamilnadu, Erode.

Vermiwash extraction

Vermiwash was extracted from vermin wash collecting device. The apparatus consists of a plastic or metal drum with a capacity of 1liter and a tap at the bottom. The drum was filled with broken bricks to about 10cm which was followed by sand layer of 2-3cm thickness, lastly filled with 1 kg of vermicompost. Simultaneously fresh water was added into the drum and a container was kept below the tap of drum. The watery extract of vermicompost i.e. vermiwash was drained out off drum and collected, drop by drop into

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the container. The color of vermiwash ranges from yellowish to black. After 1 day the process of extraction was completed.

Neem extraction

400g of Neem leaf were taken and it boiled in 2 litres of distilled water for ¼ reduction of water. Then the extract was collected.

2.6. Antioxidant activity

Chelating assay

1ml of extract with different concentration was mixed with 3.5ml methonal and then the mixture was mixed with ferrous chloride (2Mm, 0.1ml) and ferrozine (1Mm, 0.2ml) for 10 min at room temperature. The absorbance was measured at 562 nm against a blank in which the extract was not added[4].

2.7. Isolation:

Collection of Soil Sample

Rhizospheric soil samples were collected from various garden lands, without stones and hard materials. Then finely powdered soil was used for our study.

3. RESULT

In this study, two plants (Maize and Rye) and 8 type of Combination Nutrient were used for crop study like Control (Pot-1),10% Neem extract (Pot-2), 10% Neem Extract + 10% Vermiwash (Pot-3), 10% Neem extract + 20% Vermiwash (Pot-4), 10% Neem extract + 10% Coconut water (Pot-5), 10% Neem extract + 5% Coconut water (Pot-6), 10% Neem extract + 10% Vermiwash + 10% Coconut water (Pot-7), 10% Neem extract, 20% Vermiwash +5% Coconut water (Pot-8).

Physico, Chemical and Nutrients analysis was recorded in all base nutrients and Soil (Table 1,2). The pH of the soil is 6.8. Soil contains Nitrogen- 43 kg/Acre, Phosphorus- 2.5 kg/Acre, Potassium- 38 kg/Acre and Organic content was 4.11%.

The Calcium and Magnesium content of Coconut water, Vermiwash and Neem extract was calculated as 520 mg/l, 480 mg/l, 280 mg/l, 520 mg/l and 200 mg/l, 552 mg/l respectively.

Mg/l Calcium hardness = ml. EDTA titrant x 1 x 1000/ ml.

The maximum increase in Calcium was observed in 10%Neem extract+ 20% Vermiwash. Calcium was highly present in Vermiwash is due to availability of Calcium in Vermiwash.

The Vermiwash was found to improve the trace element content of the soil. However the combination of these was found to be more effective in soil micronutrients.

Table 1 Physico, Chemical and Nutrients analysis recorded in all base nutrients and Soil

RAW MATERIALS	p^{H}	TDS (mg/l) (20ppt)	TOTAL HARDNESS (mg/l)	CALCIUM HARDNESS (mg/l)	MAGNESIUM (mg/l)	CALCIUM (mg/l)
Coconut water	7	9330	1500	1300	480	520
Vermiwash	7	1604	800	700	520	280
Neem extract	6	750	600	500	552	200
10% Neem extract	8	1354	800	680	636.8	272
10% Neem extract + 10% Vermiwash	9	1390	900	500	780	200
10% Neem extract + 20% Vermiwash	9	1230	1500	700	1332	280
10% Neem extract + 10% Coconut water	7	2050	1300	600	1156	240
10% Neem extract + 5% Coconut water	8	1710	900	700	732	270
10% Neem extract + 10% Vermiwash + 10% Coconut water	6	1740	1000	600	856	240

10% Neem extract + 20% Vermiwash + 5% Coconut water	10	1460	1200	600	1056	240

Table-2: Characterization of Soil

S.No	PARAMETERS	RESULT
1	Nitrogen	43 kg/Acre
2	Phosphorus	2.5 kg/Acre
3	Potassium	38 kg/Acre
4	pH	6.8
5	Organic content	4.11%

TOTAL BACTERIA COUNT (TBC)

Table (4 to 9) enlisted the Biometric analysis on 20th, 30th ,40th day for Maize and Rye plant. Biometric study consists of Shoot length (cm), Root length (cm), Total plant length (cm), Leaf length (cm), Width (cm) and Branches No's).

In the 40th day, the maximum Shoot length, Root length and Total Plant length was recorded in 10% Neem extract+ 20% Vermiwash (Pot-4) in Maize plant (59cm, 10.9cm and 69.9cm) followed by Rye plant showed (56cm, 8.3cm and 64.3cm) in 10% Neem extract+ 10% Coconut water (Pot-5) Table 4.4 & 4.5 (Figure 5 to 14). Number of branches, Leaf length and Width were showed greater value for Maize plants (44cm and 11cm). The Rye plants showed high Leaf length 55cm in 10% Neem extract+ 10% Vermiwash (Pot-3) and high Width in 9.3cm 10% Neem extract+ 20% Vermiwash (Pot-4)

Table.3 Biometric Analysis of Mice Plant (20th day)

PARAMETERS	Pot-1	Pot-2	Pot-3	Pot-4	Pot-5	Pot-6	Pot-7	Pot-8
Shoot length(cm)	41	31	37	36	27	32	29	21
Leaf Length(cm)	35	27	29	28	19.6	23	26	15.5
Branches(No's)	5	6	5	6	4	7	7	7
Width(cm)	0.9	0.6	0.7	0.5	0.7	1.3	0.5	0.6

Table.4.1 Biometric Analysis of Rye Plant (20th day)

PARAMETERS	Pot-1	Pot-2	Pot-3	Pot-4	Pot-5	Pot-6	Pot-7	Pot-8
Shoot length(cm)	32	20	30	25	23.3	27	22	19
Leaf length(cm)	27	23.3	33	17	28	26.1	27.6	19
Branches(No's)	9	7	6	8	6	8	6	4
Width(cm)	1.3	1.1	1.3	0.9	0.7	1.2	0.6	0.3

Table-4.2 Biometric Analysis of Mice Plant (30th day)

PARAMETERS	Pot-1	Pot-2	Pot-3	Pot-4	Pot-5	Pot-6	Pot-7	Pot-8
Shoot length(cm)	48	42	41	44.2	46	39	41	37
Leaf length(cm)	43	33	36	39.2	36	26	36	27
Branches(No's)	6	7	6	7	5	8	8	8
Width(cm)	1.1	0.9	1.1	1.9	0.9	2.3	1.6	1.3

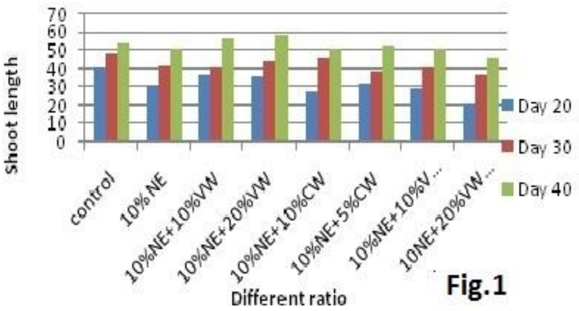


Fig.1

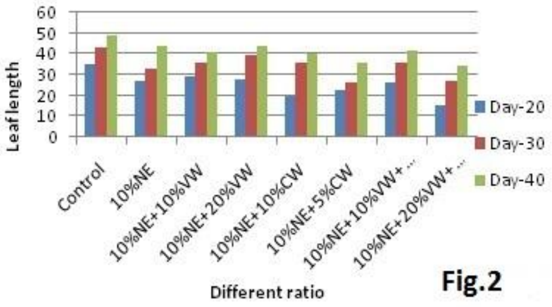


Fig.2

Fig-1 Shoot length (Maize plant)

Fig.2 Leaf Length (Maize Plant)

Table-4.3: Biometric Analysis of Rye Plant (30th day)

PARAMETERS	Pot-1	Pot-2	Pot-3	Pot-4	Pot-5	Pot-6	Pot-7	Pot-8
Shoot length(cm)	44	43	49	33.2	35	31	37	23

Leaf length(cm)	31	44	41.3	22.2	30.6	32	35	24
Branches(No's)	11	9	7	9	8	11	10	9
Width(cm)	1.6	1.3	2.1	1.5	1.2	3.7	1.5	1

Table-4.4 Biometric Analysis of Maize Plant (40th day)

PARAMETERS	Pot-1	Pot-2	Pot-3	Pot-4	Pot-5	Pot-6	Pot-7	Pot-8
Shoot length(cm)	54	51	56.5	59	51.5	53	51	46
Root length(cm)	6	5.4	6.2	10.9	7.8	6	6.7	7.7
Total plant Length(cm)	60	56.4	62.7	69.9	54.6	59	57.7	53.7
Leaf length(cm)	43.3	44	41.3	44	40	35.6	42	34.2
Branches(No's)	8	8	7	8	6	9	9	10
Width(cm)	8	9	8	11	7.6	8	9.3	7.9

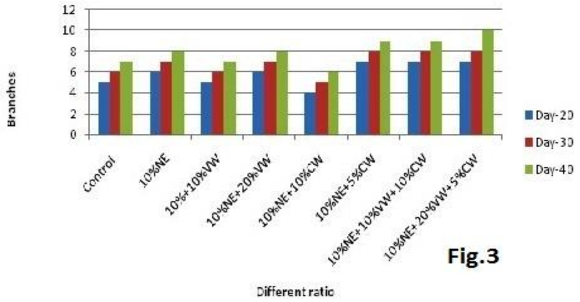


Fig.3

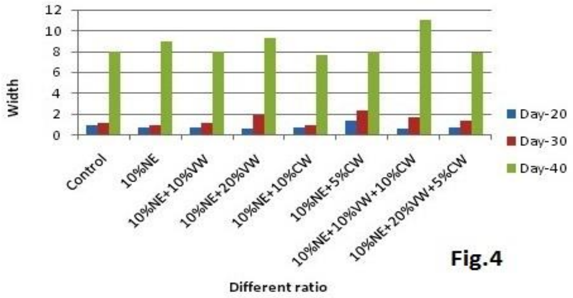


Fig.4

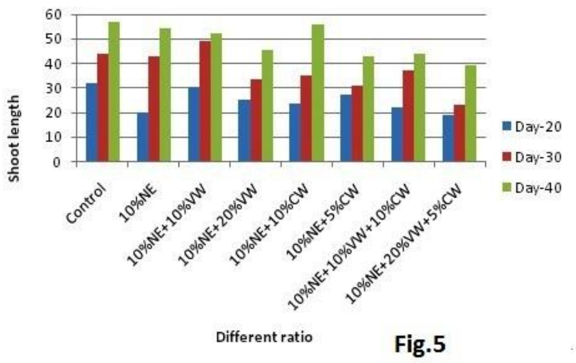
Fig 3 Branches (Maize plant)

Fig 4 Width (Maize plant)

Table-4.5: Biometric Analysis of Rye Plant (40th day)

PARAMETERS	Pot-1	Pot-2	Pot-3	Pot-4	Pot-5	Pot-6	Pot-7	Pot-8
Shoot length(cm)	57	54.2	52	45.6	56	43	44	39
Root length(cm)	7.3	9	5.9	7.5	8.3	5.6	4.9	4.7
Total plant length(cm)	64.3	63.2	57.9	53.1	64.3	48.6	48.9	43.7
Leaf length(cm)	49.3	51	55	44	40	35.6	42	34.2
Branches(No's)	12	11	8	11	9	12	12	13
Width(cm)	6	9	4.5	8.3	7.9	5.8	4.5	4.7

Pot-1: Control, Pot-2: 10% Neem extract, Pot-3: 10% Neem extract+ 10% Vermiwash,
Pot-4: 10% Neem extract+ 20% Vermiwash, Pot-5: 10% Neem extract+ 10% Coconut water,
Pot-6: 10% Neem extract+ 5% Coconut water,
Pot-7: 10% Neem extract+ 10% Vermmiwash+10% Coconut water,
Pot-8: 10% Neem extract+ 20% Vermiwash+ 5% Coconut water.



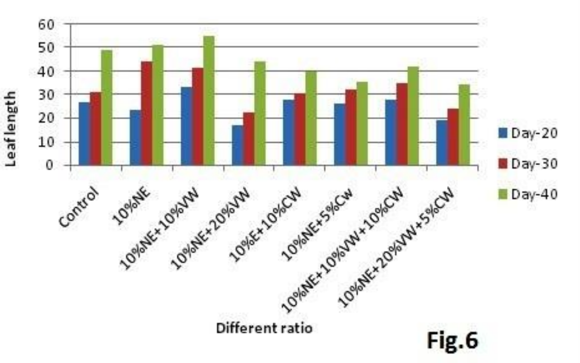
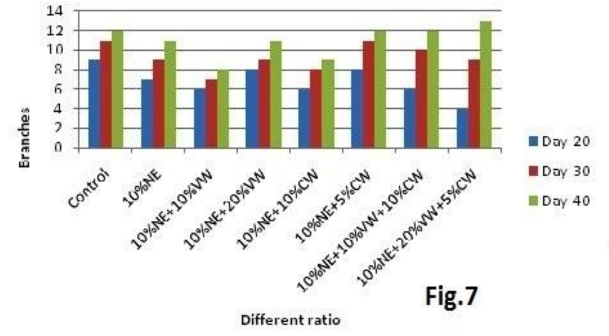


Fig 5 Shoot length (Rye plant)

Fig 6 Leaf length (Rye plant)



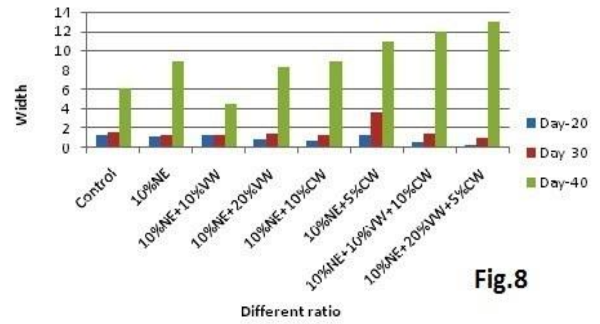
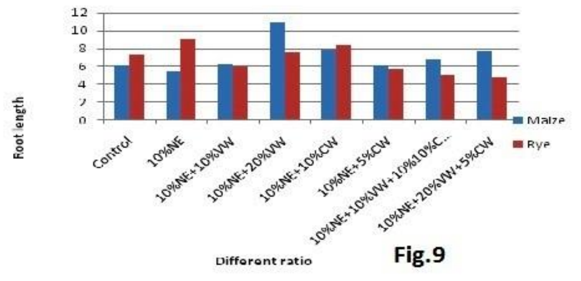


Fig 7 Branches (Rye plant)

Fig 8 Width (Rye plant)



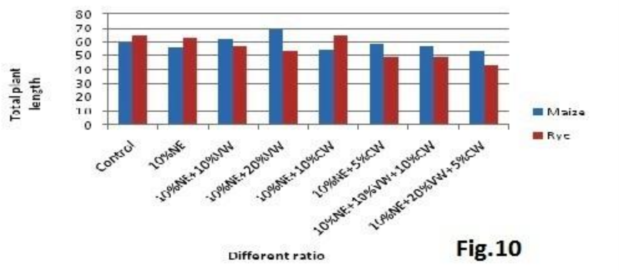
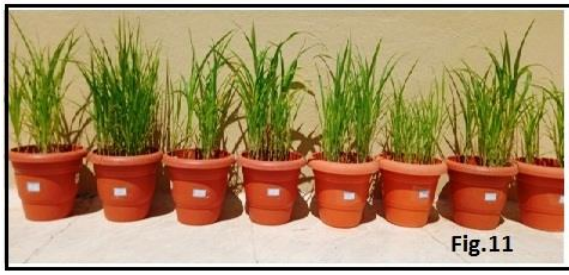


Fig 9 Root length (Maize & Rye plant)

Fig 10 Total plant length (Maize & Rye plant)

NE= Neem extract, VW= Vermiwash , CW= Coconut water



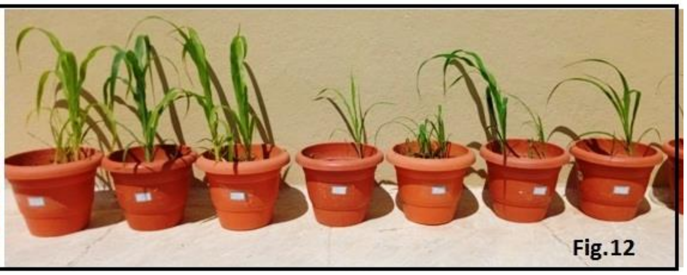


Fig 11 Maize plant 20th day **Fig 12 Rye plant 20th day**

Table-5: Qualitative Phytochemical Analysis of Maize Plant

PARAMETERS	Maize Plant															
	Pot-1		Pot-2		Pot-3		Pot-4		Pot-5		Pot-6		Pot-7		Pot-8	
	E	A	E	A	E	A	E	A	E	A	E	A	E	A	E	A
Alkaloids	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Flavonoids	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Saponins	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Tannins	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-
Proteins	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Carbohydrates	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Steroids	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenols	-	+	+	-	+	-	+	-	+	-	+	-	+	-	-	-
Terpenoids	-	+	-	+	+	-	-	-	+	-	+	-	-	+	+	-
Anthocyanin	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Cardiac glycosides	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Anthraquinone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phytosterols	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Carotenoids	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coumarin	-	-	-	+	-	+	-	+	-	+	-	+	-	+	+	+

+: Present; -: Absent E: Ethanol; A: Acetone

Qualitative Phytochemical analysis was analysed for the fresh leaf extracts of Maize and Rye plant. (Table 5, 5.1). The result showed that both plants were rich in phytochemical that are Alkaloids, Flvinoids, Proteins, Carbohydrates, Phenols, Terpenoids, Phytosterols, Coumarin (Plate 9).

Table-5.1: Qualitative Phytochemical Analysis of Rye Plant

PARAMETERS	Rye plant															
	Pot-1		Pot-2		Pot-3		Pot-4		Pot-5		Pot-6		Pot-7		Pot-8	
	E	A	E	A	E	A	E	A	E	A	E	A	E	A	E	A
Alkaloids	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Flavonoids	-	-	-	+	-	+	-	+	-	+	+	-	+	+	-	+
Saponins	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tannins	+	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-
Proteins	+	+	+	+	-	-	-	-	+	-	+	-	-	-	+	-

Carbohydrates	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Steroids	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenols	+	+	+	-	+	+	+	-	+	-	+	-	+	+	-	-
Terpenoids	+	-	-	-	+	-	+	-	-	-	+	-	-	-	-	-
Anthocyanin	-	-	-	-	-	-	-	-	-	-	-	-	-	--	-	-
Cardiac glycosides	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Anthraquinone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phytosterols	+	+	+	+	-	-	-	+	+	+	+	+	+	-	-	-
Carotenoids	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coumarin	+	+	-	+	-	+	-	+	-	+	+	+	+	-	+	+

E:Ethanol, A:Acetone,+: Present, -:Absent

PLATE 1: Qualitative Phytochemical Analysis:

Ethanol extract

Acetone extract

Table-6 showed that Quantitative phytochemical analysis of Maize and Rye. It showed maximum Protein content was in Pot-4 (5020 µg/ml) and (4740 µg/ml). Followed by Carbohydrate was rich in Pot-4 (515 mg/ml) and Pot-8 (497 mg/ml).

Table-6: Qualitative Phytochemical Analysis

RAW MATERIALS	**PROTEIN**		**CARBOHYDRATE**	
	Maize	**Rye**	**Maize**	**Rye**
Control	4160	4470	532	507
10% Neem extract	4360	4510	518	494
10% Neem extract + 10% Vermiwash	4910	4250	525	456
10% Neem extract + 20% Vermiwash	5020	4740	515	429
10% Neem extract + 10% Coconut water	4490	4290	505	471
10% Neem extract + 5% Coconut water	4940	4430	527	493

10% Neem extract + 10% Vermiwash + 10% Coconut water	4810	4730	520	454
10% Neem extract + 20% Vermiwash + 5% Coconut water	4370	4260	484	497

QUANTITATIVE ANALYSIS

Protein

Carbohydrate

Table-7 showed characterization of Rhizospheric bacteria for PGPT. The Rhizospheric bacteria was isolated from Maize and Rye plant root. It showed different colony morphology like as 1. Red, Round smooth colony, 2. White creamy enlarged colony and 3. Green colour colony. The microscopic observation showed 1 & 3 are gram negative rod and 2 was gram positive rod.

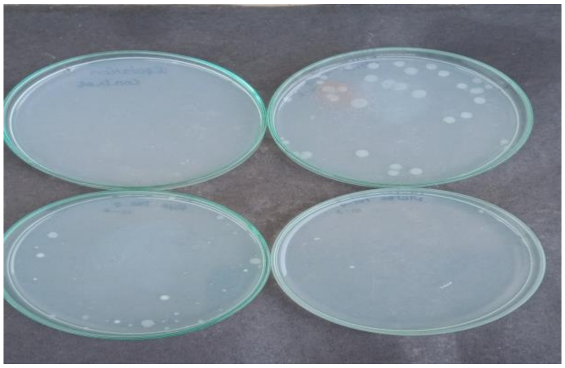
These bacteria was assayed for IAA assay, the results showed that pink colour was observed in all the srains. It indicates 3 strains had plant growth promoting hormone (IAA) (Plate-12 & 13).

Table-7: Characterization of Rhizospheric Bacteria for PGPT

POT	BACTERIAL COLONY MORPHOLOGY	MICROSCOPIC OBSERVATION	PLANT GROWTH PROMOTING HORMONES (IAA)
Pot-4 (Maize)	1.Red colour, Round, smooth Colony 2.White creamy, Enlorged colony	Gram -ve rod Gram +ve rod	Pink colour Absent Pink colour Present
Pot-2(Rye)	3.Green colour Irregular colony	Gram -ve rod	Pink colour Present

Pink colour indicates Presence of IAA (Plant growth Hormone)

PLATE 2: Isolation of Rhizosphere Bacteria



Production of Indole Acetic Acid (IAA):

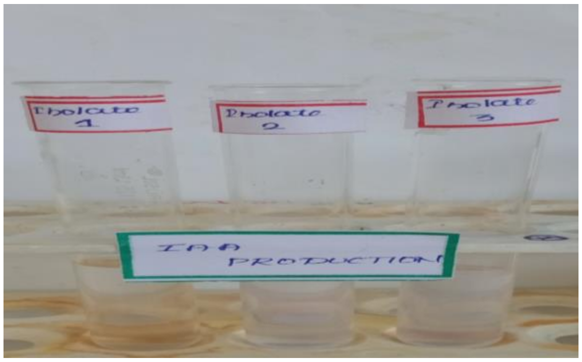


Table-8 to 8.3 showed that the antioxidant activity of plant (Maize & Rye) which was grown under different concentration. Chelatin antioxidant assay revealed that the results were in increased concentration. (Plate 2 and Fig 1 to 4).

Table-8: ANTIOXIDENT
Chelating assay -Maize plant (Ethanol extract)

Concentration (µl)	% of Inhibition							
	Pot-1	Pot-2	Pot-3	Pot-4	Pot-5	Pot-6	Pot-7	Pot-8
20	12.12	25.0	49.16	36.22	54.13	67.32	49.93	18.23
40	13.04	32.30	56.23	49.23	66.62	74.12	52.13	19.97
60	15.26	42.10	69.11	53.23	74.2	88.32	67.32	21.68
80	17.82	55.11	73.28	63.24	83.24	91.36	77.16	32.33
100	19.32	62.78	82.36	71.12	96.43	99.42	87.19	46.53

Table 8.1: ANTIOXIDANT
Chelating assay- Maize Plant (Acetone Extract)

Concentration (µl)	% of Inhibition							
	Pot-1	Pot-2	Pot-3	Pot-4	Pot-5	Pot-6	Pot-7	Pot-8
20	44.32	17.32	51.92	17.32	62.32	27.32	32.10	47.92
40	54.16	19.66	62.02	29.06	79.32	29.63	42.68	56.26
60	63.12	24.75	79.32	39.66	82.16	34.12	58.94	62.17
80	74.02	35.12	85.06	41.32	88.90	43.82	67.83	73.18
100	89.0	49.26	88.12	46.10	1.02	55.71	75.92	86.42

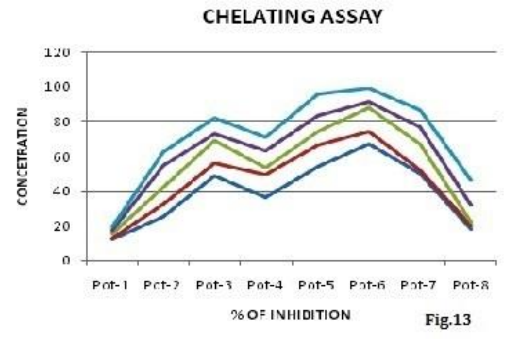
Table-8.2 ANTIOXIDANT
Chelating assay-Rye Plant (Ethanol Extract)

Concentration (µl)	% of Inhibition							
	Pot-1	Pot-2	Pot-3	Pot-4	Pot-5	Pot-6	Pot-7	Pot-8
20	21.13	41.32	35.57	57.23	29.97	59.97	17.32	77.12
40	36.24	53.12	49.23	67.13	32.42	63.32	18.16	87.32
60	47.12	62.12	54.62	78.23	44.32	76.56	20.12	96.34
80	56.32	73.12	66.11	84.36	56.32	87.26	31.27	104.13
100	69.12	88.60	79.32	97.18	68.13	98.12	43.66	1.03

Table-8.3: ANTIOXIDANT
Chelating assay- Rye Plant (Acetone Extract)

Concentration (µl)	% of Inhibition							
	Pot-1	Pot-2	Pot-3	Pot-4	Pot-5	Pot-6	Pot-7	Pot-8
20	12.34	66.31	43.02	27.51	75.52	57.10	19.52	39.90
40	14.32	70.40	59.70	36.56	87.26	62.85	25.50	43.72
60	24.16	82.63	62.0	48.92	96.84	73.55	39.82	54.94
80	31.17	95.71	78.51	59.93	1.09	84.88	41.89	67.50
100	46.52	99.81	80.67	64.17	1.23	99.52	52.35	78.40

Pot-1: Control, Pot-2: 10% Neem extract, Pot-3: 10% Neem extract+ 10% Vermiwash,
Pot-4: 10% Neem extract+ 20% Vermiwash, Pot-5: 10% Neem extract+ 10% Coconut water,
Pot-6: 10% Neem extract+ 5% Coconut water,
Pot-7: 10% Neem extract+ 10% Vermmiwash+10% Coconut water,
Pot-8: 10% Neem extract+ 20% Vermiwash+ 5% Coconut water.
Fig-1: Chelatin Assay- Maize plant (Ethanol Extract):



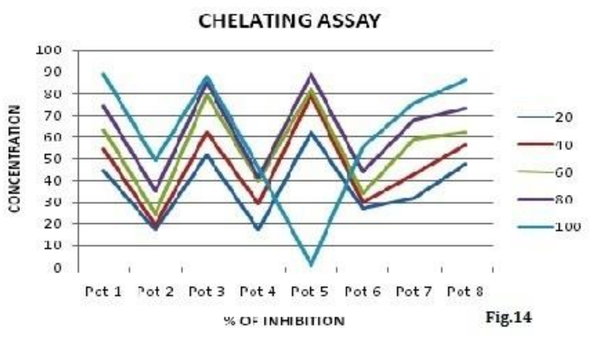


Fig 13 Chelating Assay- Maize plant (Ethanol Extract) Fig 14 Chelating Assay- Maize plant (Acetone Extract)

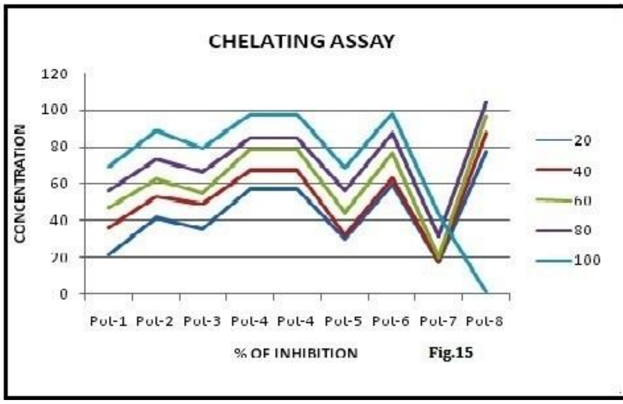


Fig.15

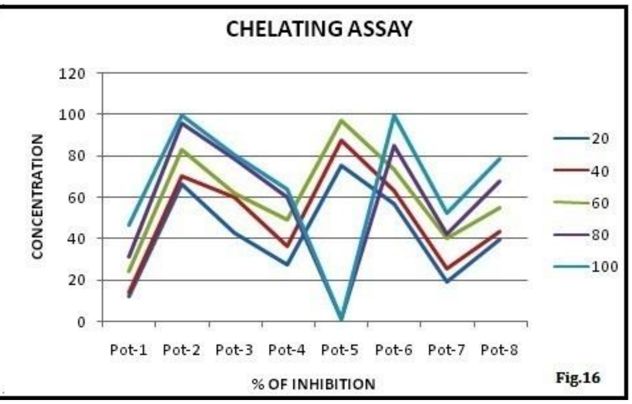
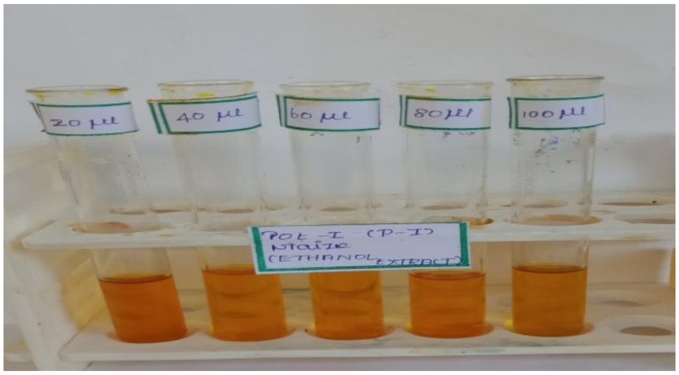


Fig.16

Fig 15 Chelating Assay- Rye plant (Ethanol Extract): **Fig 16 Chelating Assay- Rye plant (Acetone Extract)**

PLATE 3: CHELATING ASSAY – ANTIOXIDANT



4. DISCUSSION

The foliar application of aqueous mixture of the combinations of vemiwash with Neem oil, leaf and bark has increased the brinjal plant growth, early flowering, and increased productivity [5].

The combination of vermicompost and vermiwash [VW+VC] recorded greater percentage of fats and protein content in okra as compare to control [6]. The vermiwash influence the fruit quality. Organic formulations have potential to enhance the quality of crop [7].Organic formulations have to capacity to reduce pest and diseases infestation [8].

Vermiwash acts as pesticide, disease curative and crop tonic and increase the yield of lab beans [9,10]. The foliar spray of vermiwash provides necessary nutrients to the growing plant for elongation, early flowering and fruiting phase.

Using sterilized clarified coconut water as a growth medium reduced the lag phase and enhanced the log phase of eight different microorganisms including E. coli and S. aureus [11]. The most significant and useful components in coconut water are cytokinins, which are a class of phytohormones. In addition to various plant-related functions, it was also found that some cytokinins (e.g., kinetin and trans-zeatin) showed significant anti-ageing, anti-carcinogenic, and anti-thrombotic effects [12].

Other components found in coconut water include sugars, sugar alcohols, lipids, amino acids, nitrogenous compounds, organic acids and enzymes[13], and they play different functional roles in plant and human systems due to their distinct chemical properties.

All neem products are to inhibit the growth of *F. solani* at seedling stages of shisham. However, 15% neem oil concentration was most effective at almost growth stages of shisham seedling studied, which is in agreement with previous studies; Locke reported that 2 to 10% neem oil has been completely controlled *A. alternata, A. niger* and *F. oxysporum* in the field. 0.1% neem oil showed significant control in the growth of *M. phaseolina, R. solani* and *F. moniliforme*. It was reported that 0.025% neem oil was quite effective against

Aspergillus species[14]. Although, the effective dosage of neem oil reported in these studies is quite lower than observed in our study (15%).

The rate of decomposition and accumulation of soil organic matter is determined by such soil properties as texture, pH, temperature, moisture, aeration, clay mineralogy and soil biological activities. Fertilization is also one of the soil and crop management practices, which exert a great influence on soil quality [15].

It was experimented with black gram (*Vigna mungo*) cultivation where earthworm casts was applied, there was an increase in leaf length, number of leaves, root length and height of plants. It was reported enhancement of growth and yield parameters such as leaf area, fresh and dry weight of plants in vermicompost added blackgram cultivation [16].

Vermicompost also improved the physical structure of the soil, enriched the soil with microorganisms and improved the water holding capacity of the soil. Arabidopsis accessions showed large variation in supporting growth of rhizospheric bacterium Pseudomonas fluorescens in a hydroponic system [17].

The rhizosphere soils contain efficient microbes, and researcher differentiates them into beneficial and harmful categories based on their beneficial effect on soil sustainability, crop growth, and yield. Microbes play vital roles in soil sustainability and nutrient acquisition [18,19].

The plant-microbe interactions may be classified into beneficial, neutral, or harmful to the plant, depending on the beneficial and harmful effect on specific microorganisms and plants. The bacteria present in the rhizosphere act as PGPR; they have the ability to enhance PGP atmospheric N fixation, hormone production, specific enzymatic activity, and plant and insect protection by producing antibiotic and other pathogen-depressing substances. Slow release of nutrients which contribute to the residual pool of organic N and P in the soil, reducing N leaching loss and P fixation [20].

5. CONCLUSION

The research paper reveals the effect of vermicompost on growth, yield and quality of plants. Organic amended in the form of vermicompost and vermiwash, when added to soil increase the yield and growth of plants. Vermicompost and vermiwash treatments improve the micronutrient levels in the soil. The carbon content in vermi composted soil is found to release the nutrients slowly into the soil and thereby aiding the plants to absorb the available nutrients. Vermicompost treatment enhanced the availability of nutrients in the soil and reported a considerable increase of nitrogen in vermicomposted soil. Thus the vermicompost usage was applied in maize and rye plant was performed and the analysis was made. The growth of root, shoot, branches, width and their growth were compared. Comparative analysis was applied for antioxidant activity and chelating assay using ethanol and acetone extract. These extractions revealed that Rye plant has grown well compared to Maize plant. Thus vermicompost can be used a best antibacterial agent in plant growth

REFERENCES

[1] Ansari A. A., & Sukhraj K., (2010) . Efect of vermiwash and vermicompost on soil parameters and productivity of okra (Abelomoschus esculentus) in Guyana. *Afr J Agric Res* 5:1794-1798.

[2] Arditti J., (2008). Micropropagation of Orchids, 2nd ed.; Blackwell Publishing: *Oxford, UK* ; Volume II.

[3] Baker, C. J., Saxton, K. E., Ritchie, W. R., Chamen, W. C. T., Reicosky, D. C., Ribeiro, F., Justice, S. E., & Hobbs, P. R., (2007). No-tillage Seeding in Conservation Agriculture*. Food and Agriculture Organization of the United Nations*. p. 341.

[4] Bot A., & Benites J., (2005). The importance of soil organic matter. *Food Agriculture Organization*. p. 95.

[5] Bulgarelli, D., Schlaeppi, K., Spaepen, S., Van Themaat, E. V. L., & SchulzeLefert, P. (2013). Structure and functions of the bacterial microbiota of plants. Annu. Rev. *Plant Biol*. 64, 807–838.

[6] Chander K., Goyal S., Nandal D. P., Kapoor K. K., (1998). Soil organic matter, microbial biomass and enzyme activities in a tropical agroforestry system. *Biol. Fert. Soils,* 27: 168-172.

[7] Edwards, C. A., & Bohlen, P. J., (1996).Biology and ecology of earthworms. 3rd Eds. London, Chapman and Hall;426.

[8] Esakkiammal B., Lakshmibai L., & Sornalatha S., (2015). Studies on the combined effect of vermicompost and vermiwash prepared from organic wastes by earthworms on the growth and yield parameters of dolichous lab lab*. Asian J. Pharmaceutical Sci. Technol.*5(4):246-252.

[9] Gopalakrishnan S., Kannan I. G. K., Alekhya G., Humayun P., Meesala S. V., & Kanala D., (2015). Efficacy of jatropha, annona and parthenium biowash on Sclerotium rolfsii, Fusarium oxysporum f. sp. ciceri and Macrophomina phaseolina, pathogens of chickpea and sorghum. *African J Biotechnol;* 9(47):8048-8057.

[10] Gorakh N., Keshav S., & Singh D. K., (2009). Chemical analysis of vermicompost/vermiwash of different combination of animal, agro and

kitchen wastes. *Aus. J Bas. & Appl. Sci* 3(4):3672-3676.

[11] Harborne J B (1973). Phytochemical methods ,Chapman and Hill

[12] HarpreetWalia, Subodhkumar and Sarojarora (2011). Comparative antioxidant analysis of hexane extracts of Terminaliachebula Retz. Prepared by maceration and sequential extraction method*. J. Med. plant*. 5(13) : 2608-2616.

[13] Kokate C K (1994). Practical Pharmacognosy, 4th ed.,VallabhPrakasan, Delhi, PP.107 – 113

[14] Mohammadi K., Nabiollahy K., Aghaalikhani M., & Khormali F., (2010). Study on the effect of different tillage methods on soil physical properties & yield and yield components of wheat cultivars. *Iran. J. Plant. Prod. 16*(4): 77-91.

[15] Osazuwa, O.E.,& Ahonkhai I., (1989).Coconut water as growth medium for micro-organisms, *Niger. J. Palms Oil Seeds* 10–11 ,91– 95.

[16] Sani A A, Ilyas M, and Haruna A K (2007). Phytochemical Screening of the leaves of Lophiralanceolata (Ochanaceae*) Life Science Journal*. 4(4), 75-79

[17] Tiwari K.S., & Singh K., (2016). Combined effect of liquid biofertilizer with biopesticide on yield of tomato (Solanum lycopersicum l.) and infestation of Helicoverpa armigera (hubner). J.Bio.Innov 5(1):144-163.

[18] Verma S., (2016). Bio-efficacy of organic formulations along with fertilizers on growth, yield and quality of pigeonpea [Cajanus cajan (L.) Millsp] (Doctoral dissertation, Institute of Agricultural Sciences, Banaras Hindu University).

[19] Vermeulen K., Strnad M., Kryštof V., Havlicek L., Van der Aa A., Lenjou M., Njis G., Rodrigus I., Stockman B., Van Onckelen H., Van Bockstaele D. R., & Berneman Z. N., (2002). Antiproliferative effect of plant cytokinin analogues with an inhibitory activity on cyclindependent kinases. Leukemia 16, 299–305.

[20] Gowsalya.P, S.Saravanababu. "Phytochemical and Antimicrobial Activity of Selected Microorganism of Bark Extract of the Plant Crataeva religiosa." *International Journal of Pharmaceutical & Biological Archives* 1.6 (2003): 179-181.

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